

Attention:

This document may contain unmarked Official Use Only (OUO) and/or Export Controlled Information (ECI). It must be reviewed by a Derivative Classifier (DC) and brought up to current marking standards **prior to further distribution.**

Do not release this document to any foreign national until it has been reviewed by a DC for ECI. Contact the SNL Export Control Office for guidance.

The NM Technical Library distributes OUO documents in accordance with current DOE and SNL policy.

STF-067044

RECEIVED

AUG 1 '91

COMPONENT RELIABILITY ASSESSMENT

SYSTEM: W31-3 Warhead

MAJOR ASSEMBLY: Firing Set Assembly

COMPONENT: Strong Link Switch

FAILURE EVENTS:

- J4 -- Failure of the Strong Link Switch to properly operate, given the proper unique signal.
- J6b -- Failure of a single functional contact circuit in the Strong Link Switch to close and provide proper continuity.
- s -- The probability of premature closure of one or more functional contacts in the in normal STS environments in the absence of the proper unique signal.

ASSESSMENT VALUES: J4 =

ASSESSMENT DATE: March 1988

RELIABILITY ENGINEER: J. F. Nagel, 7222

ASSESSMENT RATIONALE:

Exemption 7

In the W31-3 System, the is operated in flight, after liftoff. Thus, the switch must survive transportation, handling, and liftoff environments and then operate in an acceleration

Exemption 7

00067044

March 1988

Exemption 7

Exemption 7

Tests of the switch that do not have an adequate level of one or a combination of these environments will not be counted in assessing the switch. All Component "D" Tests are considered applicable. In Next Assembly Testing, only the "D" tests of the Firing Set, Firing Set, and Firing Set Assembly are considered applicable. In "D" tests of the and , the is enabled before any vibration or shock is applied and is not operated again for the remainder of the test. None of the Next Assembly Tests

Exemption 7

Stockpile Lab Tests (SLT), New

Material Flight Tests (NMFT), and Stockpile Flight Tests (SFT) of all systems containing the are considered applicable. Although the environments most likely to cause an failure are not applied during SLTs of some of the systems, these systems have seen typical handling, transportation, and storage environments--so, SLTs are considered applicable. NMFT units have not seen these types of environments; but because they test under actual use conditions, they are also considered applicable. The Data Summary lists the Production, Next Assembly, and System Tests used to assess the

Exemption 7

Exemption 7

Exemption 7

and W31,

and the

tests counts or Next Assembly and System Tests in the Data Summary reflect this.

There have been a number of problems and failures of the switch during Production "D" testing. Only those failures judged to be applicable to the W31-3 are listed in the Data Summary. All five failures assessed against the MC2935 for evaluating Event J6 occurred in Component Lot Acceptance D-Tests. Two of these failures were units that had one of two rotor return springs on the #1 rotor broken. The units operated properly with only one of the two springs present. However, the calculated forces with only one spring are marginal. These failures will be counted, because it is difficult to assure that all springs are perfect and will survive the additional vibration and use during normal stockpile environments. A unit in Lot 1225 failed after vibration, due to a galled output shaft blade. This type of failure also occurred in Lots 1241, 1247, 1254, 1255, and 1271; but these lots were subsequently screened to eliminate possible defective units and restricted to the W80, which has a very low acceleration requirement. Since Lot 1225 was not screened, one failure will be counted against the switch. Two units (Lots 1358 & 1360) have locked up during acceleration due to particles jamming between the solenoid rotor and its housing. Although the lock-up occurred during acceleration, the jamming was a direct result of the preceding vibration, so these failures are counted against all users of the MC2935. There have been no failures of the MC2935 in Next Assembly and System Tests that were judged applicable to the W31 System. Based on five failures in 1442 units tested, the probability of failure of the to operate, given the correct unique signal (Event J6), is assessed

Exemption 7

March 1988

at 0.003. The Data-Assessment Comparison Chart presents a visual comparison of the data used to assess Event J6.

In all of the testing discussed above, there have been two instances of a single open functional contact. The first occurred early in production during an acceleration test. The contact closed momentarily, then reopened. The failure did not repeat. This failure will not be counted for assessing these events since it occurred early in the MC2935 production and corrective action was taken. The second open functional contact occurred after operational shock. The tester also indicated that the contact closed after the entire pulse sequence. The problem would not repeat, and post mortem did not reveal a cause. It is believed that this open contact was either a tester or cable problem and will not be counted for assessing the probability of an open contact, given the switch has been operated. Based on engineering judgement, the probability of failure of a single functional contact circuit (Event J6b) is believed to be no greater than 0.0001 and is assessed at that value. This assessment is supported by the 100 percent test results of over 55,000 functional contacts in the WR^{Exemption 7} produced to date.

Event s, the probability of premature closure or bypass of one or more functional contacts in the^{Exemption 7} in normal STS environments in the absence of the proper unique signal, is judged to be less than 0.0001. Rotation of the output switch contact rotors is controlled by the snap action assembly through a positive drive. Reverse rotation of the output shaft is also prevented by detent tabs that engage fixed pins on the housing. Forward rotation of the output shaft is prevented by a set of yokes until the yokes are lifted. The output shaft has no stored energy until the proper unique signal has begun to be applied to the solenoids. The yokes are prevented from lifting by safety arms until the desired transfer point is reached by the input shaft of the snap action assembly. In Component 100% Testing the switch is subjected to 12 lockup tests (test for lockup on receipt of an incorrect actuate signal), with failure of any of the tests resulting in rejection of the unit. In Component "D" Testing the units are subjected to another 13 lockup tests, with no failures to lockup reported in this testing.

Internal bridging of contact circuits is precluded by the approximately 90 degrees of rotation required for closure of the circuits and by the fact that two particles of foreign material would have to be present to complete a circuit. The output switch volume is almost completely filled with ceramic to restrict movement of any foreign material. Ceramic is used for the contact terminal headers and the output terminals are on the opposite side of the switch housing from the input terminals. Each unit (100%) is subjected to 500V output switch breakdown tests. There have been no failures during these tests. Thus, these tests of over 55,000 output circuits support the assessed premature probability (<0.0001) for the^{Exemption 7}

Data Summary
MC2935

<u>Source</u>	<u>Quantity Tested</u>	<u>Failures</u>	<u>Lots</u>	<u>Comments</u>
Component Lot Acceptance				
D-Tests 1001-1377	620	2		One open functional circuit.
			1002	During acceleration. Failure did not repeat.
			1198	No cause found.
		5		Catastrophic operation failures.
			1070	Units had one of two return springs on #1 rotor
			1098	broken. Unit operated with B61 signal inputs.
				Failure due to defect in spring. Screened lot and
				drew another sample unit.
			1225	Unit failed after vibration. Output shaft blade
				galled. Lots 1241, 1247, 1254, 1255, and 1271 also
				had failures, but these lots were subsequently
				screened to eliminate the bad units.
			1358	Both units failed to operated during acceleration.
			1360	The failures were caused by particles jamming between
				the rotor and solenoid housing.
Next Assembly				
<u>Acceptance Tests</u>				
Exemption 7	W85)	96	0	
Exemption 7		82	0	
Exemption 7	(W31-3)	31	0	
Next Assembly Subtotal	209	0		

Data Summary (continued)
MC2935

<u>Source</u>	<u>Quantity Tested</u>	<u>Failures</u>	<u>Lots</u>	<u>Comments</u>
<u>System Tests</u>				
W31 (Cycle 23)				Testing of the W31-3 began during Cycle 23.
SLT	7	0		
SFT	3	0		
Exemption 7				Exemption 7
				er system test, included in count.
NMFT	46	0		
SLT	168	0		
SFT	70	0		
Exemption 7				
NMFT	9	0		
SLT	68	0		
SFT	10	0		
Exemption 7				Exemption 7
				r system test, included in count.
NMFT	56	0		
SLT	56	0		
SFT	20	0		
Exemption 7				Exemption 7
W85 (Cycle 4)				er system test, included in count.
NMFT	8	0		
SLT	68	0		
SFT	20	0		
<hr/>				
System Test Subtotal	613	0		119 NMFT, 367 SLT, 127 SFT
<hr/>				
All Tests	1442	5		Catastrophic operation failures.
		2		Open functional circuit failure.
<hr/>				

DATA-ASSESSMENT COMPARISON CHART

Exemption 7

Event J4

KEY	
•	Data not in SUM
	Upper 90 Pct Conf Lmt
○	Single Data Source
○	Point Estimate
□	50 Pct Conf Limit
●	Combined Data Sources
●	Point Estimate
■	50 Pct Conf Limit

